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An Addition to the Urodele Fauna of Kansas from the Lower Pliocene.

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FOR several years expeditions from the Museum of Vertebrate Paleontology have collected in a rich field opened in a sand quarry in Sherman county, Kansas, where a large number of rare specimens was obtained. This fine, silty sand layer of Pliocene age consists of a stratum about twenty feet below the surface of the surrounding prairie. It is rich in animals of the period, and to date, after three years of research, has yielded the following vertebrates:

PERISSODACTYLA: *Aphelops, Parahippus, Merychippus, Pliohippus.*
ARTIODACTYLA: *Prosthenops (serus?), Procamelus, Pliauchenia; Prosthenops crassigenis, Dromomeryx. Blastomeryx.*
RODENTIA: *Mylogaulus* sp., *Sciurus* sp.
CARNIVORA:
Canidæ: *Ælurodon, Borophagus cyonoides.*
Mustelidæ: *Brachypsalis marshalli.*
Felidæ: *Pseudælurus, Machærodus.*
CHELONIA: Species not determined.
AVES: Fragments not determined.
REPTILIA: Fragments not determined.
AMPHIBIA: Anura not determined; Urodeles: *Plioambystoma kansense,* new genus, new species.

This material consists of disarticulated skeletons that have been deposited in the Pliocene sands and then covered, to remain until discovered by the three summer expeditions. Along with the larger material, smaller bones were discovered, and to secure these fine-meshed sieves were used, by means of which a mass of material, representing more than a hundred skeletons of the urodele amphibian, was secured, consisting entirely of the one species of urodele, with some fragments of another amphibian, an anuran, which has not been described because of the scantiness of the material of this par-

ticular form. It is to be hoped that other expeditions will uncover more of this fauna and that the entire amphibian population can be determined for this early period of the Pliocene.

From the conditions under which they were found it seems probable that these adult amphibia were deposited in an eddy of an early Pliocene river, covered with silt and sand, and then to have remained undisturbed for some thirty million years, until their recovery a few years ago.

Plioambystoma kansense is quite similar to the modern form, *Ambystoma tigrinum* in size and probably resembled it in color, since all of the Ambystomidæ have a somewhat similar type of coloration. In life it was about eight inches long, and probably lived much as do the Ambystomidæ of the present day.

The problems presented by this material are numerous: (1) To what group does it belong? The skeletal parts are clearly those of an amphibian with biconcave vertebræ and a skull typical of the urodeles. (2) Does the material represent one or more genera or species? Since there is ample material, comparison can be made of a series of 100 or more elements, and it is shown that the animals were all of the same type, with identical proportions, shape and bone markings. (3) To what particular group does it belong? This is a question of comparison with known modern forms, until a decision can be made. It was found that it could be included in the family Ambystomidæ and was close to the genus *Ambystoma*. The family, in so far as it is known at present, is an American product, with one representative, strangely enough, found in Siam. The total number of species known at present is about twelve.

While close to the genus *Ambystoma* in relationship, the new genus is much older and much more primitive in its palatal region, and for this reason a new genus was created, *Plioambystoma*.

The roof of the mouth in the Ambystomidæ is very typical, with the vomers and palatines united to form a vomero-palatine, while the pterygoid is retracted and not in contact with these anterior skull elements at all. However, in the axolotl stage the palate is different, as the pterygoids then extend anteriorly and are in contact with the palatines, and perform the function of bracing the quadrate by connecting it with the anterior region of the palate through the connection with the palatines. This ancestral condition is retained in *Plioambystoma*, as it shows the palatines attached to the pterygoid and extending forward to connect with the vomers, thus forming a brace. This stabilizes the weak connection of the quadrate, which is

supported only by the thin squamosal and needs the additional attachments to make it solid for the articulation of the mandibles. No vomers were found in the material, so their condition is unknown, but it is suggested that their condition was somewhat as in the axolotl. In a series of fifty-one pterygoids studied but three were unbroken and joined to the palatine, thirty-one showed clearly where the palatine had broken off, while the rest were so broken as to offer no evidence either way. While there is variability in the pterygoid, the form is fairly definite and shows a number of differences separating it from *Ambystoma*. In perfect specimens teeth were found in position on the palatines, and from their remaining bases the number could be determined as being 6 to 8.

The other elements of the skull were compared and a number of significant differences were found separating the new genus from *Ambystoma*. The maxillæ are decidedly different in proportion and in the number of teeth. Premaxillæ, maxillæ, palatines and dentaries were found with a few teeth still in place. These teeth are different in the average number on the elements, and also different in shape, those of *Ambystoma* being cone-shaped while those of *Plioambystoma* are knobbed at the end and generally have a small cleft at the tip.

Among the interesting discoveries in the material were a number of stapes imbedded in the sand-filled otic capsule, loose in the sand, and anchylosed to the lip of the foramen vestibuli. In all, eight stapes were recovered. A few skeletal parts were found with natural articulations, among them a quadrate with a pterygoid attached, a few otic capsules with the parietals anchylosed in position and a few cases of attached otic capsules. In one specimen three vertebræ were found anchylosed together. These had evidently been crushed and repaired, possibly showing the results of the bite of some preying animal.

The relation of this early Pliocene form to the modern *Ambystoma* can only be conjectured, but it is highly probable that the former is an ancestral group in which the palatal relations were still retained in a simple condition.

All of the skeletal elements of the skull were found with the exception of the nasals and vomers. In the axial skeleton nothing was missing but the carpal and tarsal bones of the wrist and ankle. A complete description of the genus and species appeared in the *American Journal of Science*, vol. XVII, No. 102, pp. 504-520, June, 1929.

PLATE XXX.

UPPER.

Quarry in Sherman county, Kansas, where the urodele material was obtained. X marks the location of the deposit.

LOWER.

View showing the process of sifting the sands for the small urodele material. Mr. Martin and assistants.

PLATE XXX.

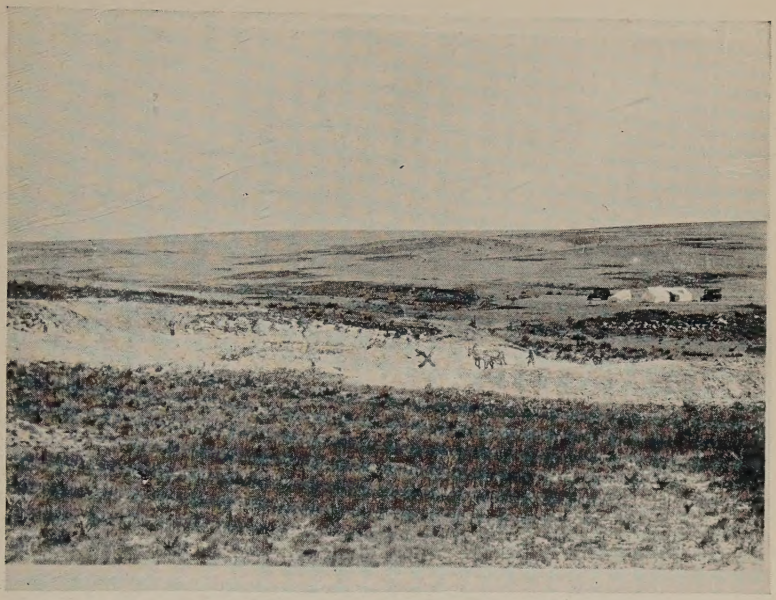

PLATE XXXI.

All of the skeletal elements of *Plioambystoma kansasenese,* natural size

1. Premaxilla, right, dorsal.
2. Parietal, right, dorsal.
3. Frontal, right, dorsal.
4. Squamosal, right, ventral.
5. Pterygoid, left, dorsal.
6. Maxilla, right, inner face.
7. Orbitosphenoid, right, lateral face.
8. Quadrate, right, inner face.
9. Prefrontal, right, ventral face.
10. Parasphenoid, dorsal face.
11. Axis, anterior face.
12. Body vertebra, ventral.
13. Sacral vertebra, dorsal.
14. Otic capsule, left, ventral.
15. Caudal, lateral.
16. Second basibranchial, dorsal.
17. Ilium, dorsal.
18. Ischium, right, lateral.
19. Scapulo-coracoid, left, lateral.
20. Humerus, left.
21. Ulna, left, dorsal.
22. Radius, left.
23. Femur, right, mesial.
24. Tibia, right, dorsal.
25. Fibula, left, ventral
26. Dentary.
27. Rib, left.
28. Rib, left.
29. Rib, left.
30. Rib, right.
31. Rib, right.
32. Rib, right sacral.

PLATE XXXI.

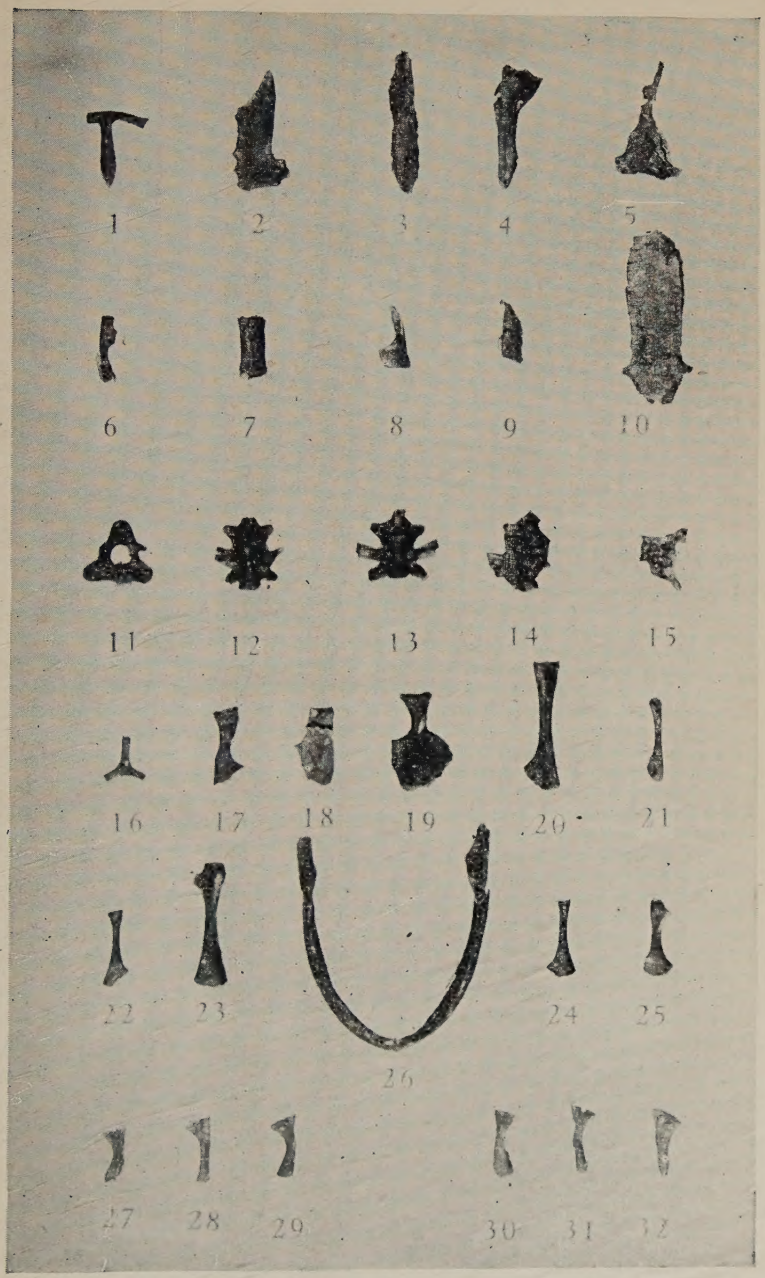
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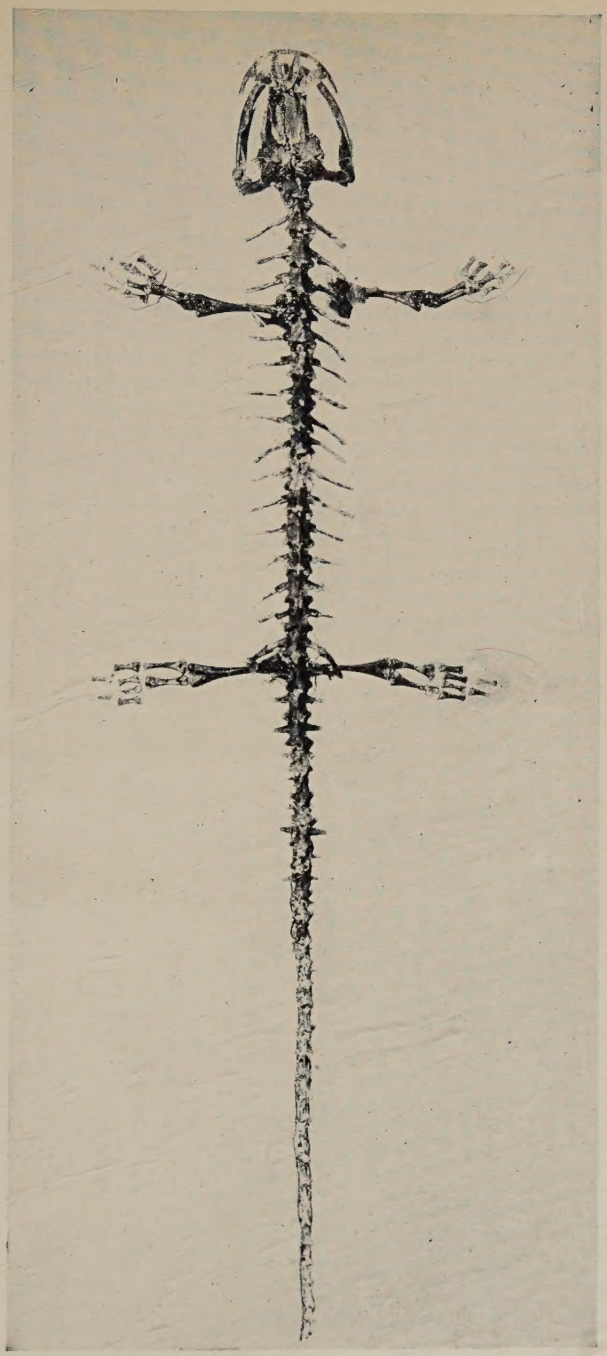
PLATE XXXII.

Restoration of the skeleton of *Plioambystoma kansasense* from elements shown on Plate XXXI, *ante*. Nine inches long.

PLATE XXXII.



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